

IN THE CLAIMS

1. (currently amended): A method of manufacturing a semiconductor device, comprising:
steps of:

embedding a copper wiring layer in an insulation layer; into a plug comprised of a semiconductor substrate;

forming a compound of copper into the copper wiring layer from thereabove;

forming a reactive layer on the compound of copper from thereabove;

forming a barrier metal layer on the reactive layer from thereabove; and a barrier metal layer interdiffused with the copper wiring layer on the compound of copper; and

interdiffusing the copper compound and the reactive layer by heat treatment to thereby form an alloy layer of copper between the copper wiring layer and the barrier metal layer.

2. (original): The method according to claim 1, wherein the compound of copper is obtained by processing the copper wiring layer according to a method selected out of nitriding, oxidizing, boronizing, sulphidizing or phosphidizing.

3. (original): The method according to claim 1, wherein the reactive layer is at least one kind of material selected from Ti, B, S, Sn, Ga, Ge, Hf, In, Mg, Ni, Nb, Pd, P, Sc, Se, Si, Zn, and Ag.

4. (original): The method according to claim 1, wherein a barrier metal for the barrier metal layer is a material selected from CoSn, CoZ, CoW, Ti, TiN; Ta, TaN, W, and WN.

5. (currently amended): A method of manufacturing a semiconductor device, comprising:
steps of:

embedding a copper wiring layer in an insulation layer; into a plug comprised of a semiconductor substrate;

forming a compound of copper into the copper wiring layer from thereabove;

forming a barrier metal layer containing a substance interdiffused with the copper wiring layer on the compound of copper from thereabove; and

heat treating and allowing the compound of copper and the barrier metal layer to react by the heat treatment to thereby form an alloy layer of copper and a barrier metal layer on the copper wiring layer.

6. (original): The method according to claim 5, wherein the compound of copper is obtained by processing the copper wiring layer according to a method selected out of nitriding, oxidizing, boronizing, sulphidizing or phosphidizing.

7. (original): The method according to claim 5, wherein the substance reacted with the copper is at least one kind of material selected from Ti, B, S, Sn, Ga, Ge, Hf, In, Mg, Ni, Nb, Pd, P, Sc, Se, Si, Zn, and Ag.

8. (original): The method according to claim 5, wherein a barrier metal for the barrier metal layer is a material selected from CoSn, CoZ, CoW, Ti, TiN, Ta, TaN, W, and WN.

9. (previously presented): The method according to claim 1, wherein the copper wiring layer is buried and the compound of copper is formed on an exposed surface of the copper wiring layer.

10. (currently amended): The method according to claim 9, wherein the insulation layer comprises a semiconductor substrate, and wherein the compound of copper is formed at a surface of the semiconductor substrate.

11. (previously presented): The method according to claim 5, wherein the copper wiring layer is buried and the compound of copper is formed on an exposed surface of the copper wiring layer.

12. (currently amended): The method according to claim 11, wherein the insulation layer comprises a semiconductor substrate, and wherein the compound of copper is formed at a surface of the semiconductor substrate.

13. (previously presented): The method according to claim 1, wherein the alloy layer of copper is not formed by an ion exchange reaction.

14. (previously presented): The method according to claim 5, wherein the alloy layer of copper is not formed by an ion exchange reaction.

15. (previously presented): The method according to claim 1, wherein the heat treatment is above 100 °C.

16. (previously presented): The method according to claim 5, wherein the heat treating is above 100 °C.

17. (new): The method according to claim 1, wherein the steps are performed in the sequence recited.

18. (new): The method according to claim 5, wherein the steps are performed in the sequence recited.